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# Installation and User Guide



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## UpIR - Upward-looking Diffuse Reflectance Accessory

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**Part Number**

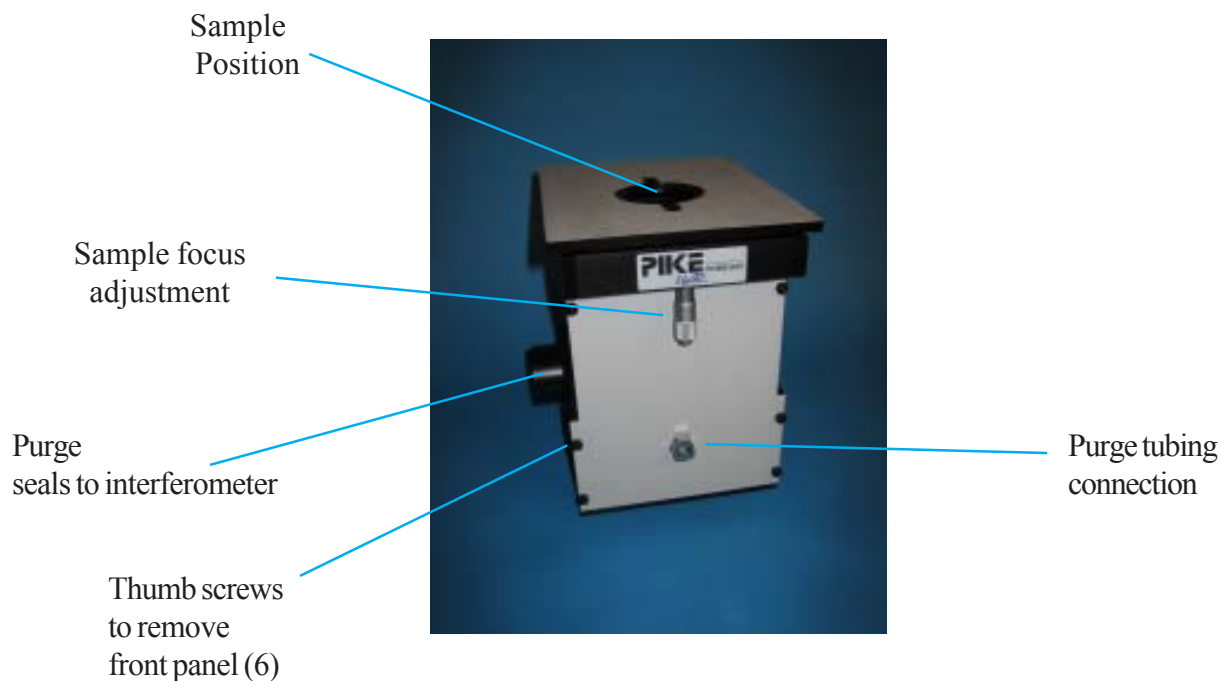
**350-044002**

# INTRODUCTION

The PIKE Technologies Upward Looking Diffuse Reflection Accessory is an ideal device to measure the wide angle reflectance of samples with an easy face-down sample placement. The design employs a high efficiency fixed ellipsoidal reflector to collect the maximum amount of diffusely reflected energy from the sample. The optical elements of the accessory are all reflective, thus the spectral range covers both the mid and near-infrared range. The 044-10xx series UpIR has aluminum reflective elements. The optical elements of the 044-60xx series UpIR are gold coated to provide the maximum signal possible for both mid and near IR applications.

The sample position is on the top surface of the accessory. The sample position can be covered by an optional IR or NIR transparent window, upon which a sample may be placed for the analysis of powders. An optional vial holder is available for the analysis of

The Upward Looking Diffuse Reflection Accessory is available for most FT-IR Spectrometers.

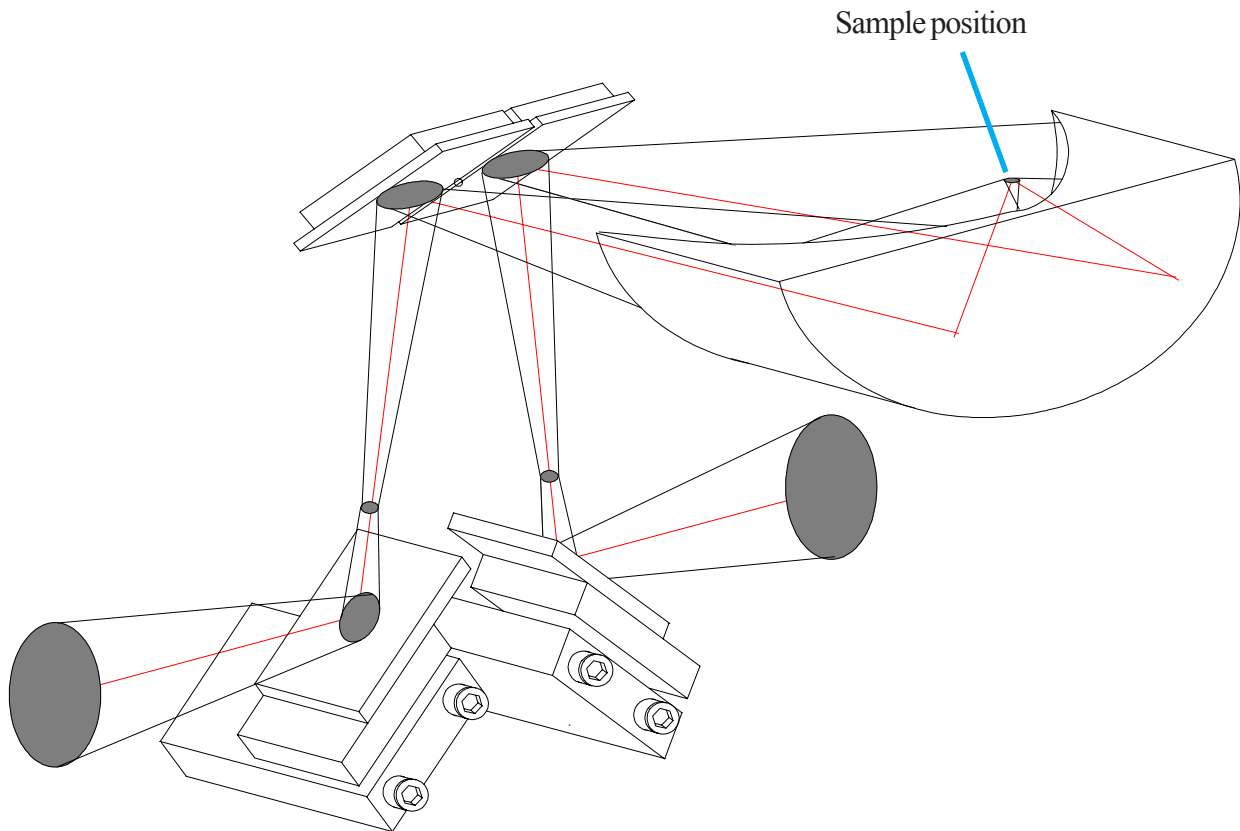


# OPTICAL DESCRIPTION

The optical system of the Upward Looking Diffuse Reflection Accessory is symmetrical with identical mirrors being used for the optical path from the spectrometer interferometer to the sample and the sample to the spectrometer detector. Two flat mirrors and a ellipsoidal mirror are used in each path. A diagram of the optical path is shown below.

The two lower mirrors are adjustable and, if necessary, are used for aligning the optical system at installation. The upper flat mirrors and ellipsoid mirror are fixed in position. The ellipsoid is a large solid angle monolithic mirror which focuses the beam onto the sample with a power of 3x. This means that if the beam in your spectrometer sample compartment with no accessory in place is 9mm in diameter, then the size of the focussed spot at the sample in the Upward Looking Diffuse Reflection Accessory will be 3mm.

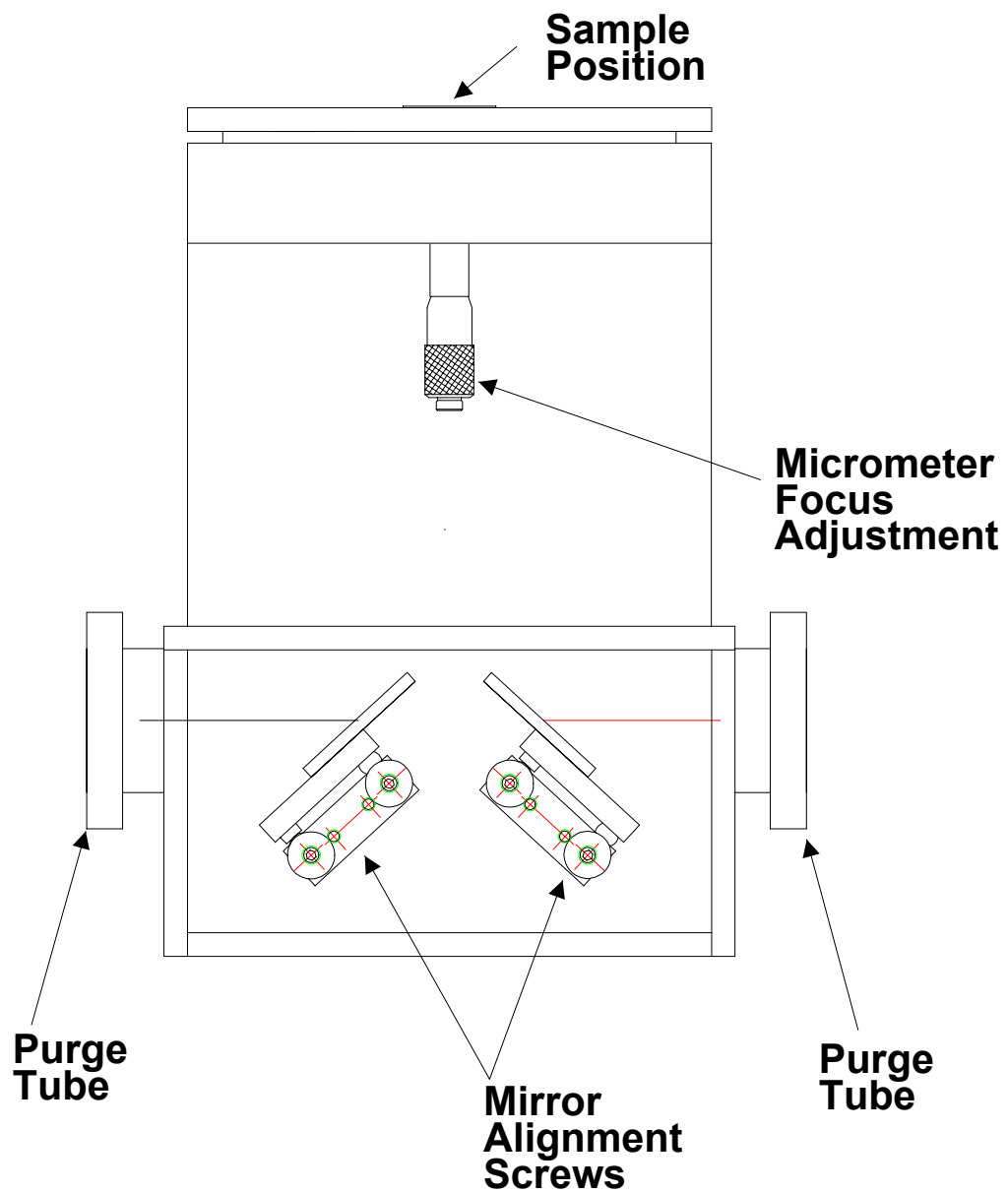
*Note that the size of the beam in the spectrometer is dependent on manufacturer. Refer to your spectrometer user guide for the correct size.*



# INSTALLATION AND ALIGNMENT OF THE ACCESSORY

Inspect the drawing below and locate the indicated items on your accessory.

**Accessory Front View**



To install the accessory in your sample compartment perform the following:

## PREPARE THE SPECTROMETER

- Remove any sample holder present in the sample compartment.
- Scan a background with your FTIR software and save either in memory or on disk, depending on the software you are using. This single beam spectrum can be used to verify the performance of the system.

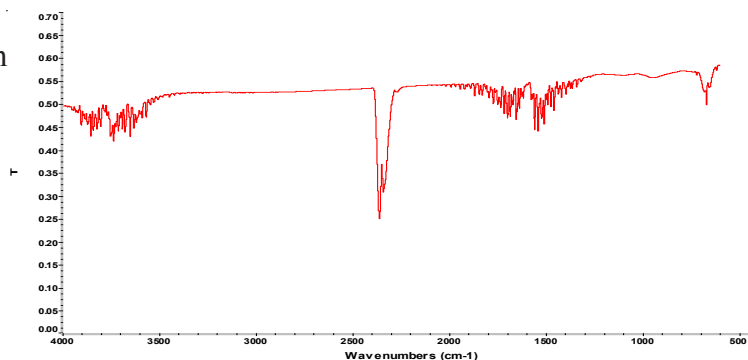
## PREPARE THE ACCESSORY

- Place the accessory into the sample compartment. Using the 3/32" wrench provided, loosen the screws on the two purge seal tubes located on the sides of the accessory. Push the tubes toward the side walls of the spectrometer. This will seal the accessory in the sample compartment. Purge tubing provided with the instrument can be connected on the front of the accessory for purging the accessory housing.
- Fix the accessory in the sample compartment. Some configurations of accessory include their own instrument sample compartment mounting plate, and this plate may be fixed in place without requiring access to the inside of the accessory.
- If your accessory does not contain an instrument sample compartment baseplate, remove the front cover of the accessory. This cover is held in place by six thumbscrews. Inside the accessory are two mirror mounts and a base fixing position. Tighten the screw in place.

## ALIGNMENT OF THE ACCESSORY

- Place the gold coated alignment mirror onto the top surface of the accessory with the mirror surface facing down.
- Set up the FTIR software to alignment or monitor mode and note the size of the interferogram. Turn the focus adjust micrometer to raise and lower the sample stage to achieve maximum throughput. The gap between the sample platen and body of the accessory should be about 1/4".

Typical throughput curve obtained with a gold mirror as sample. The background was the instrument open beam without any accessories. Typical throughput of a well-aligned UpIR should be better than 40% T.



If the throughput of the accessory is above 40%T at 1000 cm<sup>-1</sup>, the alignment is acceptable. If the throughput is less than 40%T, the mirrors inside the accessory should be adjusted:

- Remove the six thumbscrews holding the front cover in place and remove the cover. Behind this cover, there are two adjustable mirrors which are used for alignment.
- Adjust the output adjustable mirror first. This is the mirror that is the closest to the instrument detector. Turn both screws on this mirror mount to maximize throughput.
- Adjust the focus micrometer again to maximize throughput.
- Adjust the input adjustable mirror. This is the mirror that is the closest to the instrument interferometer. Turn both screws on this mirror mount to maximize throughput.
- Adjust the focus micrometer to maximize throughput.
- Repeat the last four steps until there is no further increase in signal. Typically, with this alignment procedure you should achieve a signal throughput which is at least forty percent of the signal that was present before the accessory was placed into the sample compartment.

Replace the front cover and fix in place with the six thumb screws. Your accessory is ready for sample measurements.

## PRECAUTIONS

In order to provide the maximum transmission in the infrared and near infrared, with the minimum spectral interference, the mirrors used in the 044-60xx version of the UpIR device are uncoated (bare) gold on the mirror substrates. Since the coatings are soft, care must be taken to avoid damage. Normally, these mirrors will not need cleaning, since they are contained within the housing of the accessory. If they do need cleaning, use a clean dry supply of air to blow off any dust. Under no circumstances must the mirrors be rubbed with paper products such as “Kleenex” since this will produce scratching of the mirror coating.

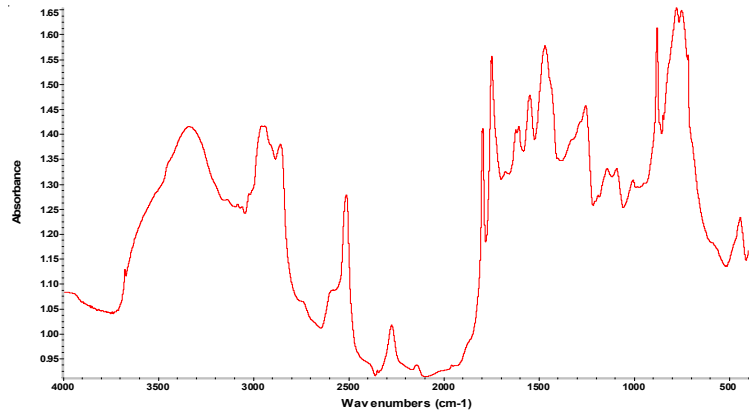
# SAMPLE PLACEMENT

The Accessory is typically used by placing the sample directly on top of the accessory. When the sample is smaller than the opening on top of the accessory, a sample holder mask should be used. A Sample Mask is included in your accessory kit. For powders of other samples with smaller particles, a sample cup can be used. A ZnSe Powder Holder is enclosed with the accessory. Powder holders can be manufactured with different window materials, the standard holder has a ZnSe window. There is an opening with two finger access slots to help insert and remove sample holders. Please make sure that the holders are properly positioned in the opening, so that the sample is situated in the plane of the top of the UpIR top plate.

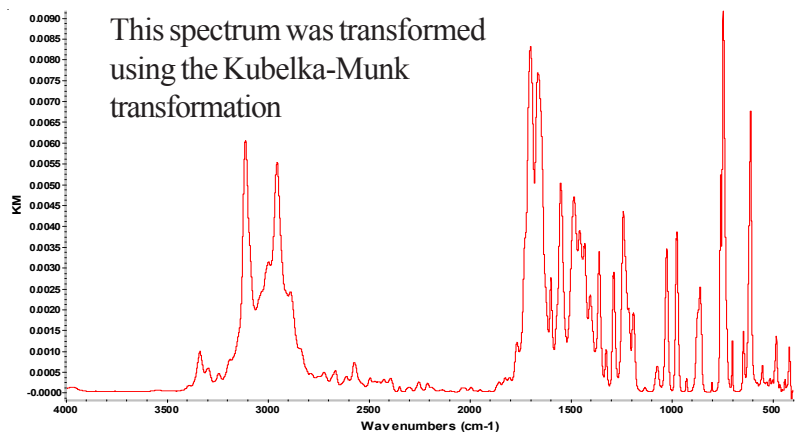


# TYPICAL SPECTRA

Using the Gold Mirror as reference, a matte beige color paint panel was measured. The test panel was placed directly on top of the accessory without any sample holder. Measurement time was less than 1 minute using 4 cm-1 resolution.



Powdered samples have to be diluted in KBr for best results. Caffeine crystals in approximately 1-5% w/w result in excellent diffuse reflectance spectra. The background was the same ZnSe holder(enclosed with the accessory) with KBr. The sample was thoroughly ground in a mortar with an agate pestle and placed on the ZnSe. The cup does not need to be filled, just the window needs to be covered for best results.



# PACKING LIST

Included with your accessory are the following parts.

- UpIR accessory



- Sample Mask and Powder Holder with ZnSe window. These are mounted on the top of the main accessory



- Gold alignment mirror



- Wrench set



- 4ft length of purge tubing



- Purge seals

